Neutron Production in Spallation Reactions of 600-2000 MeV protons on Thick Lead Target - comparison of experiment and MCNPX simulations

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Accelerator Driven Transmutation Technologies stand a good chance to become an alternative to the permanent storage of the spent nuclear fuel. The transmutation is assumed to be done by intensive neutron field produced by the spallation reactions of relativistic protons on heavy element target. Several Monte Carlo simulation codes are claiming to be able to describe the course of spallation reaction and transport of produced particles in thick target. The purpose of this study is to test reliability of their prediction by comparison with experimental data about spatial distribution of neutrons produced both in simple and in complex systems of target, uranium and surrounding moderator irradiated with relativistic energy proton beam.

We analysed three experiments carried out by us at the accelerators of JINR Dubna, Russia. The beams of relativistic protons (660 MeV, 885 MeV, 2 GeV) strike the massive cylindrical lead target (diameter 9.6 cm, length 50 cm). The distribution of the produced neutron field was deduced from the activation detectors (foils of Al, Cu, Au and Bi) placed on the surface of and near to the target. Finally we made comparison of experimentally deduced yields with Monte-Carlo based simulations performed with the MCNPX code and couple of LAHET (version 2.7) and MCNP4B code.

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